

REC'D 02 AUG 2004

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*Sertifikaat*

REPUBLIEK VAN SUID AFRIKA

PATENT KANTOOR  
DEPARTEMENT VAN HANDEL  
EN NYWERHEID



15/004102044

*Certificate*

REPUBLIC OF SOUTH AFRICA

PATENT OFFICE  
DEPARTMENT OF TRADE AND  
INDUSTRY

Hiermee word gesertifiseer dat  
This is to certify that

the documents attached hereto are true copies of Forms P1, P2  
and provisional specification of South African Patent Application No. 2003/4815 ✓  
in the name of CH Chemicals (Pty) Ltd

Filed : 20 June 2003 ✓  
Entitled : Thin Sprayed Liner

**PRIORITY DOCUMENT**  
SUBMITTED OR TRANSMITTED IN  
COMPLIANCE WITH  
RULE 17.1(a) OR (b)

Geteken te PRETORIA in die Republiek van Suid-Afrika, hierdie  
Signed at PRETORIA in the Republic of South Africa, this 15<sup>th</sup> dag van July 2004  
day of

A handwritten signature in cursive script, enclosed in a circle.  
Registrar of Patents

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REPUBLIC OF SOUTH AFRICA		REGISTER OF PATENTS			PATENTS ACT, 1978	
OFFICIAL APPLICATION		LODGING DATE: PROVISIONAL			ACCEPTANCE DATE	
21	01 <b>2003/4015</b>	22	20 JUN 2003		47	
INTERNATIONAL CLASSIFICATION		LODGING DATE: COMPLETE			GRANTED DATE	
51		23				
FULL NAME(S) OF APPLICANT(S)/PATENTEE(S)						
71	CH CHEMICALS (PTY) LTD					
APPLICANTS SUBSTITUTED:						DATE REGISTERED
71						
ASSIGNEE(S)						DATE REGISTERED
71						
FULL NAME(S) OF INVENTOR(S)						
72	HELLMANN, NEIL CHRISTOPHER					
PRIORITY CLAIMED		COUNTRY		NUMBER		DATE
N.B. Use International abbreviation for country (see Schedule 4)		33	NIL	31	NIL	32.
TITLE OF INVENTION						
54	THIN SPRAYED LINER					
ADDRESS OF APPLICANT(S)/PATENTEE(S)						
EVERGREEN ROAD, TUNNEY EXT 7, ELANDSFONTEIN, GAUTENG, SOUTH AFRICA						
ADDRESS FOR SERVICE					S & F REF	
74	SPOOR & FISHER, SANDTON			PA134498/P		
PATENT OF ADDITION NO.		DATE OF ANY CHANGE				
61						
FRESH APPLICATION BASED ON		DATE OF ANY CHANGE				

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REPUBLIC OF SOUTH AFRICA  
PATENTS ACT, 1978  
**APPLICATION FOR A PATENT** 006000  
AND ACKNOWLEDGEMENT OF RECEIPT  
(Section 30 (1) – Regulation 22)  
RASR 711

The granting of a patent is hereby requested by the undermentioned applicant on the basis of the present application filed in duplicate  
REPUBLIC VAN SUID-AFRIKA

OFFICIAL APPLICATION NO.		S & F REFERENCE
21	01	PA134498/P

FULL NAME(S) OF APPLICANT(S)	
71	CH CHEMICALS (PTY) LTD

ADDRESS(ES) OF APPLICANT(S)	
	EVERGREEN ROAD, TUNNEY EXT 7, ELANDSFONTEIN, GAUTENG, SOUTH AFRICA

TITLE OF INVENTION	
54	THIN SPRAYED LINER

THE APPLICANT CLAIMS PRIORITY AS SET OUT ON THE ACCOMPANYING FORM P.2. THE EARLIEST PRIORITY CLAIM IS:

COUNTRY: NIL	NUMBER: NIL	DATE: NIL
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THIS APPLICATION IS FOR A PATENT OF ADDITION TO PATENT APPLICATION NO.

21	01	
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THIS APPLICATION IS A FRESH APPLICATION IN TERMS OF SECTION 37 AND IS BASED ON APPLICATION NO.

21	01	
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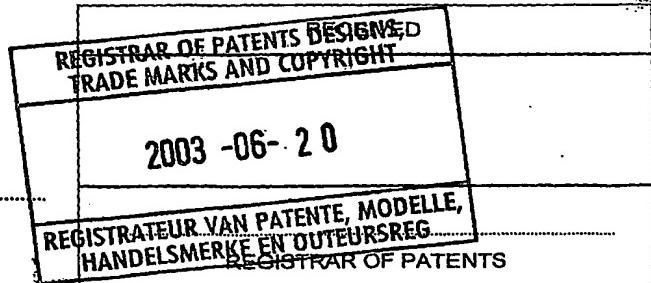
THIS APPLICATION IS ACCCOMPANIED BY:

- 1. A single copy of a provisional specification of 5 pages.
- 2. Drawings of sheets
- 3. Publication particulars and abstract (Form P.8 in duplicate).
- 4. A copy of Figure of the drawings (if any) for the abstract.
- 5. Assignment of invention.
- 6. Certified priority document.
- 7. Translation of the priority document.
- 8. Assignment of priority rights.
- 9. A copy of the Form P.2 and the specification of S.A. Patent Application No .
- 10. Declaration and power of attorney on Form P.3.
- 11. Request for ante-dating on Form P.4.
- 12. Request for classification on Form P.9.
- 13. Form P.2 in duplicate.
- 14. Other.

74	ADDRESS FOR SERVICE: SPOOR & FISHER, SANDTON
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Dated: 20 June 2003

  
SPOOR & FISHER  
PATENT ATTORNEYS FOR THE APPLICANT(S)



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REPUBLIC OF SOUTH AFRICA  
PATENTS ACT, 1978

## PROVISIONAL SPECIFICATION

(Section 30(1) – Regulation 27)

OFFICIAL APPLICATION NO.

21	01	<del>2003/4815</del>
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LODGING DATE

22	20 JUNE 2003
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FULL NAMES OF APPLICANTS

71	CH CHEMICALS (PTY) LTD
----	------------------------

FULL NAMES OF INVENTORS

72	HELLMANN, NEIL CHRISTOPHER
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TITLE OF INVENTION

54	THIN SPRAYED LINER
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**12003/4849**

**DEED OF ASSIGNMENT OF INVENTION**

WHEREAS I, Hellmann, Neil Christopher

of Evergreen Road Tunney Ext. 7 Green Hills, Elandsfontein, 1401,  
Gauteng, South Africa

are the Inventor of an invention entitled Thin Sprayed Liner

AND WHEREAS CH Chemicals (Pty) Ltd

of Evergreen Road, Tunney Ext 7, Elandsfontein, Gauteng, South Africa

(hereinafter referred to as THE ASSIGNEE) has acquired the invention from me :

NOW THEREFORE:

- (1) I hereby cede and assign the invention to THE ASSIGNEE with the right to apply for patents in respect of the invention in the Republic of South Africa and in any other country in the name of THE ASSIGNEE.
- (2) I hereby undertake to execute all such documents as may be required to file and prosecute patent applications in respect of the invention in any country and to execute all documents and to do all things as may be required by the law of any country to effect transfer of the invention into the name of THE ASSIGNEE, all at the expense of THE ASSIGNEE.

This assignment takes effect prior to the date of filing of the patent application for the invention.

Signature:

Hellmann, Neil Christopher

Date: 17 - 1 - 03

**SPOOR & FISHER**  
Patent and Trade Mark Attorneys  
Ref : PA134498/P

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REPUBLIC OF SOUTH AFRICA  
PATENTS ACT, 1978  
**DECLARATION AND POWER OF ATTORNEY**  
(Section 30 - Regulations 8, 22(l)(c) and 33)

PATENT APPLICATION NO.		S & F REF	LODGING DATE	
21	02	PA134498/P	22	20 June 2003

FULL NAME(S) OF APPLICANT(S)	
71	CH CHEMICALS (PTY) LTD

FULL NAME(S) OF INVENTOR(S)	
72	HELLMANN, NEIL CHRISTOPHER

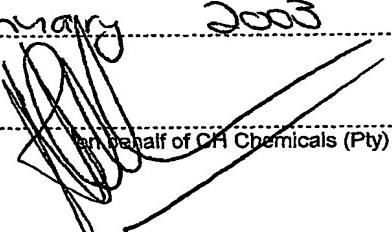
EARLIEST PRIORITY CLAIMED	COUNTRY	NUMBER	DATE			
NOTE: The country must be indicated by its International Abbreviation - see schedule 4 of the Regulations	33	NIL	31	NIL	32	NIL

TITLE OF INVENTION	
54	THIN SPRAYED LINER

- \* I/we hereby declare that :-
- 1. I/we am/are the applicant mentioned above;
  - 2. I/we have been authorised by the applicant to make this declaration and have knowledge of the facts herein stated in the capacity of Authorised Signatory of the applicant;
  - \*\* 3. the inventor of the abovementioned invention is the person named above and the applicant has acquired the right to apply by virtue of an assignment from the inventor;
  - 4. to the best of my/our knowledge and belief, if a patent is granted on the application, there will be no lawful ground for the revocation of the patent;
  - 5. this is a convention application and the earliest application from which priority is claimed as set out above is the first application in a convention country in respect of the invention claimed in any of the claims; and
  - 6. the partners and qualified staff of the firm of SPOOR & FISHER, patent attorneys, are authorised, jointly and severally, with powers of substitution and revocation, to represent the applicant in this application and to be the address for service of the applicant while the application is pending and after a patent has been granted on the application.

SIGNED AT Ederwale THIS 17<sup>th</sup> DAY OF January 2003

No legalization necessary

  
On behalf of CH Chemicals (Pty) Ltd

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## A THIN SPRAYED LINER

### BACKGROUND TO THE INVENTION

THIS invention relates to polyurethane based thin sprayed liner.

### SUMMARY OF THE INVENTION

According to the present invention, there is provided a liner for preventing spalling of rock particles and falls of ground at rock excavation sites, the liner including:

- a water based dispersion of polyurethane; and
- a cementitious material,

wherein the cementitious material and the dispersion are mixed together to form a polymer concrete which, prior to setting, may be applied to the surface of excavated rock.

According to another aspect of this invention, the liner may be utilised to provide waterproofing of the surface of the excavated rock. The liner may also be utilised in this manner for application on other substrates such as on external walls and structures.

The liner may also be used as a moisture barrier. The water based dispersion of polyurethane is typically comprised by mass of approximately 56% synthetic polymer and 44% water. The ratio of the water based dispersion to the cementitious material may range from between approximately 1:9 to 9:1.

The dispersion may be a combination of polyurethane and other organic polymers, such as acrylic resins.

Generally, the ratio of water based dispersion of polyurethane to other organic polymers is approximately 1:1. The dispersion is then combined with the cementitious material. The cementitious material is generally comprised of a mixture of a cement, an aggregate and/or chemical admixtures. The mixture may be prepared in a number of widely ranging combinations. The chemical admixtures may include hardening, flow and quick drying agents and water scavengers while the concrete admixtures are generally provided in the form of super plasticizers and accelerators.

The cementitious material may include a combination of ordinary Portland or high alumina cement, sand, water and cement extenders, but may also include additional fibrous material, such as glass fibres or synthetic fibres, to increase the tensile strength of the liner. The fibrous material may also include organic fillers such as rubber crumb.

Preferably, the liner is sprayed onto the surface of the excavated rock or substrate using a spray gun including a pneumatically operated shotcrete machine.

An embodiment of the invention is described in detail in the following passages of the specification, by way of example only.

#### DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

In the mining industry it is common practice, following blasting, to line excavated rock walls in mines with a skin of settable cementitious grout, which may or may not incorporate meshing and lacing as reinforcement. The grout is used primarily to improve the integrity of the wall structure and to inhibit the spalling of rock particles, particularly from the hanging walls between mine packs, roof bolts and other standard support systems. It is also common practice to line excavated rock, foundations, external walls and structures with a water proofing membrane to prevent damage to the structure by unwanted ingress of moisture.

Although it has been recognised that polyurethane liners could potentially be utilized in such applications, polyurethanes have typically contained volatile organic compounds (VOCs). These VOCs may be released on application, when polyurethane is sprayed on to the rock surface, requiring protective equipment to be worn. More importantly,

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normal polyurethanes release toxic fumes upon combustion and, consequently, the use of such polyurethanes is not recommended in confined areas. These factors, coupled with the prohibitive costs normally associated with polyurethanes, relative to cementitious products, have prevented the use of polyurethane products in mining and waterproofing applications.

Recent developments have seen new water based dispersions of polyurethanes, notably the product SYNTegra being developed by the Dow Chemical Company, which do not contain the dangerous VOCs. These new generation polyurethane dispersions do not suffer from the toxicity concerns expressed above and contain approximately 56% polyurethane polymer and 44% water, by mass, and may be applied by air assisted spraying and air-dried.

Evidently, the Dow Chemical Company and CHC Urethane Products (Pty) Ltd have tested products formed by combining water based dispersion together with cementitious materials, including cement extenders and sand. It has now been found that the water in the dispersion makes the product particularly useful when combined with cementitious materials, resulting in the product forming the subject of the current invention. It has also been found that the ratio of the water based dispersion to the cementitious material may range from between approximately 1:9 to 9:1. Water in the dispersion is consumed during the curing reaction and results in a waterproof polymer concrete product having enhanced adhesive and physical properties when subjected to load conditions.

Tests suggest that a combination, by mass, of approximately 25% polyurethane dispersion, 25% of other organic polymers dispersion, such as acrylic resin, and 50% cementitious mix comprising a high alumina cement produces the most desirable result. However, it is believed that the polyurethane and the organic polymer may each be applied within a range of between approximately 5% and 75%, with the remainder being formed from the cementitious mix. It will be appreciated that the inclusion of the acrylic resin or any other organic polymer is preferable, but is not a necessary component of the invention.

The design of the cementitious component of the liner can be varied depending upon the application under consideration. The cementitious mix will generally comprise a

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combination of: high alumina cement; sand; aggregate; cement or concrete admixture, such as super plasticizers and accelerators; cement extenders; chemical admixtures, such as hardening, flow and quick drying agents and water scavengers; and water. However, the mixture may also include fibrous material, such as glass fibres or synthetic fibres, to increase the tensile strength of the product, and/or organic fillers, such as rubber crumb.

In applying the liner to a rock surface or a surface of a substrate or structure, the liner may be painted or trowelled onto the surface manually, but is preferably applied using a shotcrete gun or a pneumatically or electrically operated spray gun, as with cementitious grouting applications generally, to form a thin sprayed liner. With such liners, the combination of elongation and stiffness is critical to the success of the liner in preventing rock falls or substrate damage and the ultimate collapse of the structure or mine excavation. The dispersion provides the elastic deformation and improved tensile strength characteristics of the liner, while the cementitious mix improves the stiffness. The combination of both characteristics also provides a waterproofing barrier for the rock face or the surface of a substrate or structure.

The water based dispersion polyurethane alone can evidently achieve an elongation of over 700% prior to failure. However, when used in combination with the cementitious material, a polymer concrete is formed of an interpenetrating network of inorganic and organic polymers, increasing the stiffness. In addition, there is the additional benefit of the water in the dispersion of polyurethane being used in the curing of the cement and the product is consequently particularly suited to the treatment of recently excavated rock structures in mining applications, most substrate surfaces and structures requiring waterproofing.

DATED THIS 20<sup>TH</sup> DAY OF JUNE 2003

SPOOR & FISHER  
APPLICANT'S PATENT ATTORNEYS

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